HISTORIC COLUMBIA RIVER HIGHWAY,
SANDY RIVER BRIDGE
(Stark Street Bridge)
Troutdale vicinity
Multnomah County
Oregon

HAER No. OR-36-B

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

HISTORIC COLUMBIA RIVER HIGHWAY, SANDY RIVER BRIDGE (Stark Street Bridge)

HAER No. OR-36-B

Location:	Spanning the Sandy River east of Troutdale on Stark Street at its intersection with the Historic Columbia River Highway, in Multnomah County, Oregon, at milepost 16.7. UTM: 10/549950/5040200 Quad: Washougal, Wash.--Oreg.
Date of Construction:	1914
Engineer:	K. P. Billner, designing engineer, Oregon State Highway Department
Builder:	George H. Griffin and Portland Bridge Company
Owner:	Multnomah County
Present Use:	Vehicular and pedestrian traffic
Significance:	One of the oldest steel truss highway bridges in Oregon and the second oldest steel truss constructed on the Historic Columbia River Highway. Provided a vital link across the Sandy River at the beginning of the HCRH.
Historian:	Robert W. Hadlow, Ph.D., September 1995
Transmitted by:	Lisa M. Pfueller, September 1996

PROJECT INFORMATION

This recording project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. The HAER program is administered by the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Division of the National Park Service, U.S. Department of the Interior. The Historic Columbia River Highway Recording Project was cosponsored in 1995 by HABS/HAER, under the general direction of Robert J. Kapsch, Ph.D., Chief, and by the Oregon Department of Transportation (ODOT), Bruce Warner, Region One Manager; in cooperation with the US/International Committee on Monuments and Sites (ICOMOS), the American Society of Civil Engineers (ASCE), and the Historic Columbia River Highway Advisory Committee.

Fieldwork, measured drawings, historical reports, and photographs were prepared under the direction of Eric N. DeLony, Chief of HAER; Todd A. Croteau, HAER Architect, and Dean A. Herrin, Ph.D., HAER Historian. The recording team consisted of Elaine G. Pierce (Chattanooga, Tennessee), Architect and Field Supervisor; Vladimir V. Simonenko (ICOMOS/Academy of Fine Arts, Kiev, Ukraine), Architect; Christine Rumi (University of Oregon) and Pete Brooks (Yale University), Architectural Technicians; Helen I. Selph (California State Polytechnic University, Pomona) and Jodi C. Zeller (University of Illinois, Urbana-Champaign), Landscape Architectural Technicians; Robert W. Hadlow, Ph.D. (ASCE/Pullman, Washington), Historian; and Jet Lowe (Washington, DC), HAER Photographer. Jeanette B. Kloos, ODOT Region One Scenic Area Coordinator; and Dwight A. Smith, ODOT Cultural Resources Specialist, served as department liaison.

Additional information about the Historic Columbia River Highway can be found under the following HAER Nos.:

OR-36	HISTORIC COLUMBIA RIVER HIGHWAY
OR-36-A	HISTORIC COLUMBIA RIVER HIGHWAY, SANDY RIVER BRIDGE AT TROUTDALE
OR-36-C	HISTORIC COLUMBIA RIVER HIGHWAY, CROWN POINT VIADUCT
OR-36-D	HISTORIC COLUMBIA RIVER HIGHWAY, CROWN POINT
OR-24	LATOURELL CREEK BRIDGE
OR-23	SHEPPERDS DELL BRIDGE
OR-36-E	HISTORIC COLUMBIA RIVER HIGHWAY, BRIDAL VEIL FALLS BRIDGE
OR-36-F	HISTORIC COLUMBIA RIVER HIGHWAY, WAHKEENA FALLS FOOTBRIDGE
OR-36-G	HISTORIC COLUMBIA RIVER HIGHWAY, WEST MULTNOMAH FALLS VIADUCT

OR-36-H	HISTORIC COLUMBIA RIVER HIGHWAY, MULTNOMAH CREEK BRIDGE
OR-36-I	HISTORIC COLUMBIA RIVER HIGHWAY, MULTNOMAH FALLS FOOTBRIDGE (Benson Footbridge)
OR-36-J	HISTORIC COLUMBIA RIVER HIGHWAY, EAST MULTNOMAH FALLS VIADUCT (Bridge No. 841)
OR-36-K	HISTORIC COLUMBIA RIVER HIGHWAY, ONEONTA GORGE CREEK BRIDGE
OR-36-L	HISTORIC COLUMBIA RIVER HIGHWAY, ONEONTA TUNNEL
OR-36-M	HISTORIC COLUMBIA RIVER HIGHWAY, HORSETAIL FALLS BRIDGE
OR-49	MOFFETT CREEK BRIDGE
OR-36-N	HISTORIC COLUMBIA RIVER HIGHWAY, TOOTHROCK & EAGLE CREEK VIADUCTS
OR-36-O	HISTORIC COLUMBIA RIVER HIGHWAY, TOOTHROCK TUNNEL
OR-36-P	HISTORIC COLUMBIA RIVER HIGHWAY, EAGLE CREEK BRIDGE
OR-36-Q	HISTORIC COLUMBIA RIVER HIGHWAY, EAGLE CREEK RECREATION AREA (Forest Camp)
OR-36-R	HISTORIC COLUMBIA RIVER HIGHWAY, MITCHELL POINT TUNNEL & VIADUCT (Tunnel of Many Vistas)
OR-36-T	HISTORIC COLUMBIA RIVER HIGHWAY, MOSIER TWIN TUNNELS
OR-36-U	HISTORIC COLUMBIA RIVER HIGHWAY, MOSIER CREEK BRIDGE (Bridge No. 498)
OR-30	DRY CANYON CREEK BRIDGE
OR-27	MILL CREEK BRIDGE
OR-56	COLUMBIA RIVER HIGHWAY BRIDGES

For shelving purposes at the Library of Congress, Troutdale vicinity in Multnomah County was selected as the "official" location for the various structures in the Historic Columbia River Highway documentation project (HAER No. OR-36).

HISTORIC COLUMBIA RIVER HIGHWAY

The Pacific Northwest's Columbia River Highway, later renamed the Historic Columbia River Highway (HCRH), was constructed between 1913 and 1922. It is one of the oldest scenic highways in the United States. Its design and execution were the products of two visionaries: Samuel Hill, lawyer, entrepreneur, and good roads promoter and Samuel C. Lancaster, engineer and landscape architect, with the assistance of several top road and bridge designers. In addition, many citizens provided strong leadership and advocacy for construction of what they saw as "The King of the Roads."

Often, the terms "scenic highways" and "parkways" are used synonymously. Scenic highways are best described as those roads constructed to provide motorists with the opportunity to see up-close the landscape's natural beauty. Parkways are roads or streets often associated with city beautiful campaigns prevalent in the United States in the late 19th and early 20th centuries. They were part of a movement to create park-like settings out of wastelands. Many of the scenic highways in the United States are associated with the country's national park system and were built in the years following the First World War.

Beginning in the 1910s and early 1920s, the National Park Service (NPS) began construction of well-engineered paved roads with permanent concrete and masonry bridges and viaducts to make its park sites more accessible to an increasingly mobile tourist population. These included roads such as "Going-to-the-Sun Highway" in Glacier National Park and "All-Year Highway" in Yosemite National Park. The Historic Columbia River Highway, unlike many of its counterparts, was constructed through county-state cooperation. It became a state-owned trunk route or highway, part of a growing system of roads that criss-crossed Oregon.

Samuel Hill, once an attorney for James J. Hill and his large railroad empire, and later a Pacific Northwest investor and entrepreneur, was the state of Washington's most vocal good roads spokesman in the late 19th and early 20th centuries. He promoted good roads at Seattle's Alaska-Yukon-Pacific Exposition in 1905, and shortly thereafter helped to establish the department of highway engineering at the University of Washington. With little success in convincing the Washington State Legislature to fund a major highway along the Washington side of the Columbia River, Hill found more receptive ears and pocketbooks with Oregon lawmakers and Portland area businessmen. Construction began on the Historic Columbia River Highway in 1913. By 1922, it was

complete, covered in a long-wearing and smooth-riding asphaltic-concrete pavement.[1]

Hill hired Samuel Lancaster, an experienced engineer and landscape architect to design the Historic Columbia River Highway. Lancaster was noted for the boulevards that he created around Seattle's Lake Washington in the first decade of the 20th century as a component of the city's Olmsted-designed park system. In 1909 Lancaster had become the first professor of highway engineering in Hill's department at the University of Washington. Lancaster had accompanied Hill and others to Paris in 1908 for the First International Road Congress, and afterwards the delegation toured western Europe to learn about continental road-building techniques. Seeing roads in the park-like setting of the Rhine River Valley inspired Hill to build a highway along the Columbia River Gorge. By 1912, Lancaster was conducting road-building experiments at Hill's estate, Maryhill, 100 miles east of Portland on the Washington side of the Columbia. The route they subsequently created was not a parkway, in the truest sense, but instead a scenic highway.[2]

The Columbia River Gorge's natural features distinguish it as the ideal setting. This relationship between the natural landscape and the Historic Columbia River Highway was described best by locating engineer John Arthur Elliott. He wrote, "All the natural beauty spots were fixed as control points and the location adjusted to include them." The road passed several waterfalls and rock outcroppings, including Thor's Heights (Crown Point), Latourell Falls, Shepperd's Dell, Bishop's Cap, Multnomah Falls, Oneonta Gorge and Falls, Horsetail Falls, Wahkeena Falls, and Tooth Rock. Natural features were made an integral component of the Historic Columbia River Highway.[3]

According to Lancaster, "There is but one Columbia River Gorge [that] God put into this comparatively short space, [with] so many beautiful waterfalls, canyons, cliffs and mountain domes." He believed that "men from all climes will wonder at its wild grandure [*sic*] when once it is made accessable [*sic*] by this great highway." In addition, the promoters sought to create a route that utilized the most advanced techniques available for road construction. In reflecting on the work's progress, Lancaster acknowledged that because of the country's rugged climate, with its wind and rain and winter weather, it had been "slow and tedious and somewhat more expensive than ordinary work." Nevertheless, he and his associates felt they were accomplishing a worthwhile task because, "for if the road is completed according to plans, it will rival if not surpass anything to be found in the civilized world."[4]

In an more practical light, many observers saw the Historic Columbia River Highway as a lifeline connecting Portland with the many commercial and agricultural areas along the Columbia River. Some even envisioned it as part of a spider web of similarly constructed routes radiating out towards central and eastern Washington and northern Idaho, meeting routes leading to other parts of the region and nation.

The Historic Columbia River Highway was a technical and civic achievement of its time, successfully mixing sensitivity to the magnificent landscape and ambitious engineering. The highway has gained national significance because it represents one of the earliest applications of cliff-face road building as applied to modern highway construction. Lancaster emulated the European styles of road building in the Columbia River Gorge, while also designing and constructing a highway to advanced engineering standards. Throughout the route, engineers held fast to a design protocol that included accepting no grade greater than 5 percent, nor laying out a curve with less than a 200' turning radius. In rare cases where a tighter curve was used, Lancaster reduced grades and widened pavement. The use of reinforced-concrete bridges, combined with masonry guard rails, guard walls, and retaining walls brought together the new with the old--the most advanced highway structures with the tried and tested. In building the HCRH, Lancaster artfully created an engineering achievement sympathetic to the natural landscape.[5]

In the days before the formation of a comprehensive state highway plan, Multnomah, Hood River, and Wasco counties cooperated, sometimes unwillingly, with the newly-formed Oregon State Highway Commission (1913) in constructing the Historic Columbia River Highway. Initially a group of recently elected Multnomah County commissioners, strong supporters of the proposed route, resolved that the highway commission take charge of its road building activities, with access to $75,000 in county tax revenues. Soon crews surveyed the route through Multnomah County and constructed one mile of road.

Boosters stumped for the route's completion to the Hood River County line. Local clubs sent out men and boys for weekend work parties to show public support for the undertaking. One photograph from the period depicts work parties with picks and shovels in hand, and placards such as "Gang No. 7, Portland Ad Club, Stalwarts," or "Gang No. 3, Portland Realty Board, We will ROCK the Earth." The highway received much patronage, although some citizens were less than enthusiastic about its construction. Opponents showed their views with placards declaring, "I WON'T WORK, To Hell With Good Roads, We Don't Own Autos." Many "mossbacks" had no use for good roads and were satisfied

traveling the network of rutted, narrow, steeply-graded backwoods trails. Nevertheless, the public generally supported the highway's construction. Multnomah County Commissioners levied a direct tax sufficient to fund road building to the Hood River County line, and subsequently, the people voted a $1 million bond issue to pave the road with asphalt.[6]

Other counties similarly supported this scenic highway innovation. In 1914, Hood River County voters approved the sale of $75,000 in bonds to initiate their portion of the road's construction. Finally, in 1915, Wasco County commissioners financed a survey to locate the route through their jurisdiction. By 1916, though, the state highway commission was reorganized and given a greater mandate over state highway construction, taking much of it out of local hands. Passage of the Federal Aid Road Acts of 1916 and 1921 gave the Oregon State Highway Commission matching funding to complete the Historic Columbia River Highway through Wasco County, and eventually to complete the route to its eastern terminus at Pendleton, in Umatilla County, by the early 1920s. At the same time, the state, working with counties west of Portland, completed another portion of the Columbia River Highway to the sea at Astoria. Eventually it became part of the national highway system and was designated part of U.S. 30.[7]

By the late 1930s, construction of Bonneville Dam, a New Deal project aimed at providing flood control on the Columbia River and generating electricity, caused a realignment of a portion of the Historic Columbia River Highway near Tooth Rock and Eagle Creek, in eastern Multnomah County. It was evident that the old highway was too outdated to provide safe, efficient travel for modern motor traffic. By 1954 it was bypassed in its entirety from Troutdale to The Dalles by a new water-level route. This new road was subsequently upgraded to a four-lane divided roadway and eventually renamed Interstate 84. Only portions of the old route remained as a reminder of its early modern highway engineering accomplishments.

SANDY RIVER BRIDGE (STARK STREET BRIDGE)

Multnomah County, Oregon, constructed the Sandy River Bridge (Stark Street Bridge) to replace an old wooden Pratt through truss. The old bridge had collapsed, coincidentally on Good Roads' Day, April 25, 1914, dropping a five-ton truck into the river. It had served as part of the county's extensive rural road system. The river crossing was at the east end of Base Line Road, which dated from 1854 when 30 people petitioned for a road to be built from the Sandy River to Portland "following the baseline as closely as possible." Base Line Road followed the

surveyor's baseline between Township 1 North and Township 1 South, of Range 3 East, Willamette Meridian. It became one of three routes leading from rural eastern Multnomah County to Portland.

The portion of the Sandy River near Base Line Road was popular with the Portland Automobile Club, and between 1912 and 1913 the organization constructed a frame and stone building west of the bridge for picnics and other club activities. Sometime in the 20th century Base Line Road became an extension of Stark Street and so took on this name. In 1915, shortly after completion of the Sandy River Bridge (Stark Street Bridge), a new alignment for Base Line Road carried it down a long, gradual grade past the Troutdale Road, following the river to the Portland Auto Club camp. This new route bypassed a circuitous portion of the county road system with a route consisting of tangents, and gradual curves and grades carrying it down to the river's edge at the bridge crossing.[8]

DESIGN AND DESCRIPTION

Construction began on the Sandy River Bridge (Stark Street Bridge) shortly after its predecessor collapsed. Though owned by Multnomah County, the bridge was constructed under the direction of the Oregon State Highway Department and bridge engineer Charles H. Purcell. It was constructed of one 10-panel 200'-2½" riveted Pratt camel-back through truss steel span and one 5-panel 77'-6" Warren pony truss, to a total length of 277'-8½. Originally the spans had 20'-0"-wide reinforced-concrete decks with creosoted wood block pavement. Clearance above low water was about 35'. Total length of U_6L_6 (centermost vertical) on the main span is 32'-6". Total height of the Pony span at the middle of the third panel is 12'-0".[9]

A logical reason for choosing two unequal spans over one longer span for this location was that piers from the original wooden truss were reused with some modification. In addition, the main Pratt truss appears to be of a standardized design and length. Notations on original plans suggest that the specifications for both spans came from the American Bridge Company.[10]

A new river pier crib was sunk around the old pier with some difficulty as crews encountered boulders during their excavation. Nevertheless, they found a good layer of fine sand and loose gravel 20' below the stream bed and through this drove 31 piles with a 2,000 pound hammer. The bottom of the crib was sealed with 2' of concrete poured through a tremie pipe and hopper. The

stream pier took the shape of two batter diamond-shaped legs connected by a continuous web wall. The shore abutments for the main span and the shore abutment for the Pony truss consisted of reinforced-concrete counterforted piers with batter diamond legs and continuous webs. They were founded on loose rock and sandstone.[11]

Both spans were constructed entirely of riveted rolled channel, angle steel, I-beams, and lacing, with fixed ends on the main channel pier and expansion roller shoes on the abutment piers. There were 155.10 tons of steel used in the trusses and floor system and 218.4 tons of concrete in the piers; and 930 lineal feet of piling.[12]

The state highway department prided itself on its ability to supervise construction of high-quality, low-cost bridges for county roads during 1914. It accomplished this by designing spans and advertising for construction bids in standard engineering periodicals and local newspapers. This procedure differed greatly from the way in which county governments had previously proceeded, where there was no competitive bid process among bridge building companies for contracts. One individual associated with the highway department, most likely state highway engineer Henry L. Bowlby or bridge engineer Charles H. Purcell, wrote that county courts seldom had access to a competent bridge engineer to review their bridge construction proposals. Moreover, many relied completely on private bridge companies both for design and construction. "Bridge Companies [*sic*] employ the smoothest talker for their salesman that can be secured," wrote the highway department official. He added, "This is part of the selling end of the business, and does not differ from the selling end of any other commercial business." Also, "a County Court without the services of a competent bridge engineer is helpless in the hands of the average bridge company."

One of many cost comparisons cited in the *First Annual Report of the State Highway Engineer* looked at the price advantage of the Sandy River Bridge (Stark Street Bridge) over a similar structure built by Lane County, on the south end of the Willamette Valley. While the cost-per-ton for steel for the Sandy River Bridge was $65.00, the cost-per-ton for steel for the Lane County structure was $184.72. The real difference in construction was that the Sandy River span was competitively bid, while the Lane County span was designed and built by one company, with minimal supervision by the county court. The Sandy River Bridge (Stark Street Bridge) cost $21,042.40.[13]

REPAIR AND MAINTENANCE

The Oregon State Highway Department designed and supervised construction of all bridges on the Multnomah County portion of the Historic Columbia River Highway except for the Sandy River Bridge at Troutdale (HAER No. OR-36-A). Except for the Sandy River Bridge (Stark Street Bridge), all of them became part of the state highway system in 1930 and were placed under the Oregon State Highway Department's jurisdiction. Nevertheless, Multnomah County continues to own and maintain the Sandy River Bridge (Stark Street Bridge), primarily because it lies on Stark Street, a county road, at its junction with the HCRH, a state owned route.[14]

Because of increased traffic demands, Base Line Road's western approach to the Sandy River Bridge (Stark Street Bridge) was widened in the mid-1930s. About the same time, probably as part of the road improvement project, rubble guardwalls at the eastern end of the bridge were replaced with a set that created a wider approach to the structures. The original guard walls on the bridge's east end were of the standard design used throughout the Historic Columbia River Highway, namely, random rubbleslip-joint masonry with arched drainage openings and a screeded concrete cap. In their place, the 1930s construction included ashlar basalt fences that take on the appearance of a standardized U.S. Bureau of Public Roads plan or a National Park Service plan for masonry guard rails.[15]

Maintenance records for the Sandy River Bridge (Stark Street Bridge) through the 1960s are unavailable or lost. Those from the 1970s through the early 1990s reveal that after over sixty years of service, the bridge was showing the usual signs of aging for metal truss structures. In 1974, inspectors noted damage from oversized trucks. On the Pratt truss, angle steel on the east portal's lower edge was twisted out of shape and top chord struts were bent such that vertical columns were pulled in. In addition, sway bracing was badly damaged. By the mid-1980s, comprehensive inspections by the Oregon State Highway Division bridge engineers also found spalling on the main span under deck, and exposed reinforcing bar there and in the pier. Seats and bearings were covered with debris, and the bearings in the west abutment were frozen. Paint was thin paint and there was minor section loss in floor beam flanges. Finally, the entire truss structure showed evidence of repeated encounters with oversized vehicles.[16]

In 1988, Multnomah County contracted with David L. Holt Company of Snohomish, Washington, to flame-straighten much of the Pratt truss's superstructure. That same year an in-house

inspection revealed that much of the reinforce-concrete deck's surface had degraded. By the early 1990s, the bridge received a comprehensive upgrade with new steel channel and plate added to the present superstructure. The county also strengthened one lower chord with a Dywidag rod so it could bear sidewalk loads. Finally, the concrete deck was sandblasted and given an epoxy overlay.[17]

ENDNOTES

[1]For good syntheses of the Pacific Northwest good roads' movement, see John Kevin Rindell, "From Ruts to Roads: The Politics of Highway Development in Washington State" (M.A. thesis, Washington State University, 1987) and Hugh M. Hoyt, Jr., "The Good Roads Movement in Oregon, 1900-1920" (Ph.D. diss., University of Oregon, 1966); Oral Bullard, *Lancaster's Road: The Historic Columbia River Scenic Highway* (Beaverton, OR: TMS Book Service, 1982), 31; Ronald J. Fahl, "S. C. Lancaster and the Columbia River Highway: Engineer as Conservationist," *Oregon Historical Quarterly* 74, no. 2 (June 1973): 112.

[2]Fahl, "S. C. Lancaster and the Columbia River Highway," 105-07.

[3]John Arthur Elliott, "The Location and Construction of the Mitchell Point Section of the Columbia River Highway" (C.E. thesis, University of Washington, 1929), 3.

[4]Samuel C. Lancaster to Amos S. Benson, 7 February 1914, folder "Multnomah County, 1914," box 4, RG 76A-90, Oregon State Archives, Salem.

[5]Dwight A. Smith, "Columbia River Highway Historic District: Nomination of the Old Columbia River Highway in the Columbia Gorge to the National Register of Historic Places, Multnomah, Hood River, and Wasco Counties, Oregon" (Salem, OR: Oregon Department of Transportation, Highway Division, Technical Services Branch, Environmental Section, 1984), 3.

[6]Ronald J. Fahl, "S. C. Lancaster and the Columbia River Highway: Engineer as Conservationist," *Oregon Historical Quarterly* 74, no. 2 (June 1973): 111; Samuel C. Lancaster, "The Revelation of Famous Highways: A Symposium,"in *American Civic Annual* (n.p., 1929), 109.; see photograph in the Oregon Historical Society collection, negative no. 38744; C. Lester Horn, "Oregon's Columbia River Highway," *Oregon Historical Quarterly* 66, no. 3 (September 1965): 261.

[7]*Second Annual Report of the Engineer of the Oregon State Highway Commission* (Salem, 1916): 26-30.

[8]"Highway Bridges, Multnomah County," folder "Bridge, 1914," box 2, RG 76A-90, Oregon State Archives, Salem, 11-12; "Origin of Milestones Puzzles Historian," by Sharon Nesbit, *Gresham, Oregon, Outlook*, 8 July 1971; "Portland Auto Club," in "Columbia River Highway: An Inventory of Historic Sites," Columbia River Highway Project (Cascade Locks, OR: 1981), n.p.; "Sandy Cut-Off is

Beautiful as Park Boulevard," *Portland Oregon Journal* (13 August 1916): sec. 2, p. 9; "Highway to Horsetail Falls Now Ready for Inspection," *Portland Oregonian* (5 September 1915): sec. 5, p. 2.

[9]Sandy River (Stark Street) Bridge, No. 50, Drawings Nos. 16, 17 and 18, Drawing File, Bridge Section, ODOT, Salem.

[10]Sandy River (Stark Street) Bridge, No. 50, Drawing No. 18, Drawing File, Bridge Section, ODOT, Salem.

[11]"Highway Bridges, Multnomah County," folder "Bridge, 1914," box 2, RG 76A-90, Oregon State Archives, Salem, 11-12; *First Annual Report of the State Highway Engineer* (Salem, OR: 1914), 172-74.; Sandy River (Stark Street) Bridge, No. 50, Drawings Nos. 17, 18, 19, 65, 66, 115, 120, 121, 122, and 123, Drawing File, Bridge Section, ODOT, Salem.

[12]"Exhibit A," *First Annual Report of the State Highway Engineer* (Salem, OR: 1914): n.p.

[13]"Highway Bridges," folder "Bridge, 1914," box 2, RG 76A-90, Oregon State Archives, Salem; 1; "Investigation of Recent County Bridge Construction," *First Annual Report of the State Highway Engineer* (Salem, OR: 1914): 177, 185; "Exhibit A," *First Annual Report of the State Highway Engineer* (Salem, OR: 1914): n.p.

[14]The Oregon State Highway Commission took over control of the Columbia River Highway in Multnomah County from the county on 16 January 1930. See Secretary, Oregon State Highway Commission, to Multnomah Board of County Commissioners, 17 December 1930, held by Multnomah County Road Department Archives, Yeon Complex, Gresham.

[15] Laurence Ilsley Hewes, *American Highway Practice* (New York: John Wiley and Sons): 2:432-39, including figure 164.

[16]See inspection note to file, dated 21 August 1974; and Bridge Inspection Report, Oregon State Highway Division, 16 May 1985, both in Bridge No. 11112, Maintenance File, Bridge Shop, Multnomah County Department of Environmental Services, Portland.

[17]Larry F. Nicholas, by Stan M. Ghezzi, to David L. Holt, 1988; and Bart Bonney to Stan Ghezzi, memo, 14 April 1988, both in Bridge No. 11112, Maintenance File; and interview with Ed Wortman, Engineer, 17 August 1995, both at Bridge Shop, Multnomah County Department of Environmental Services, Portland.

SOURCES CONSULTED

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DATA LIMITATIONS

There was a wealth of research resources on the Sandy River Bridge (Stark Street Bridge). These included state highway department correspondence and reports, trade journal articles, magazine articles, county bridge maintenance records, original drawings, and county commissioners records. Maintenance records from the 1910s through the 1960s were missing or no longer exist.